The Effects of Nearby Clusters of Galaxies on the Microwave Background Radiation

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The analysis of the Shapley Supercluster (SSC) which was the first target of this investigation is now complete. A detailed comparison of the HEAO A-2 and COBE DMR 4-year data has been made, and both datasets have been fitted to models for a gas distribution within the SSC, but not associated with the known clusters and point sources. This work would have been impossible without several visits to GSFC, to consult with the CDAC about the COBE dataset and to learn how to use the IDL system that was developed for analysis of the DMR data.

The main result is that no gas has been detected. For "cool" gas temperatures, this is consistent with earlier work on the SSC. For "hot" temperatures (in excess of about 15 keV), the COBE data provide a stronger limit than has been possible before.

Using these results (now submitted to the Astrophysical Journal, "Search for diffuse intrasupercluster gas in the Shapley Supercluster," Molnar, S.M. and Birkinshaw, M.), we have shown that cosmologically-interesting limits on the gas content of the cluster can be obtained with deep XTE observations, and are likely with the type of data that MAP should return.

The next steps are to apply the same techniques (using code developed in IDL) to other superclusters, and to fit models of the Rees-Sciama effect near the SSC itself. The former work will provide similar limits to the gas contents of these other clusters, and by "stacking" the results, should put good limits on the gas content of an "average supercluster". The latter task will set limits to the general-relativistic effect that a supercluster has on the propagation of the cosmic microwave background radiation: such a signal might arise if the supercluster is still accumulating matter, or if its mass is sufficient to cause major distortions in the Hubble flow. Both sets of results will set limits to the mass content of superclusters, and will bear on the cosmological cluster baryon crisis.